THE U.S. HOTEL PORTFOLIO TRANSACTIONS: PREMIUM OR DISCOUNT?

A Thesis

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Master of Science

by

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August 2019

ABSTRACT

Hotel, as part of the commercial real estate, is getting more and more attractive to the real estate investors in the form of portfolio transactions. By utilizing the hedonic pricing model, this study predicts the expected sale price of the hotels bundled within the portfolios and compares the expect portfolio sale price with the actual portfolio sale price to identify the premium and discount scenarios for the U.S. hotel portfolio transactions. The results show that, in general, about 70% of the U.S. hotel portfolios were transacted at a premium. Besides, the discount portfolios were traded at a very deep discount compared to the extent of premium for premium portfolios. In terms of the influencing factors of different scenarios, geographical diversification provides a boost to the premium scenario, however, other company-level information, buyer's type and industry, and portfolio-level characteristics, portfolio size, are not significant indicators of the premium and discount situations.

BIOGRAPHICAL SKETCH

Jinsong (Atlas) Wu was born in Changchun, Jilin Province, China. He obtained his bachelor's degree in management science from Zhejiang University with the highest honor. Before coming to The Hotel School, Cornell University, he worked as a data analyst and management trainee in Ctrip, the largest online travel agency in China. During his master's study at Cornell, he extended his field into real estate investment and finance, while corroborated his skills in data analysis.

To the impediments and uncertainties I encountered and will encounter in my life.

ACKNOWLEDGMENTS

First of all, I would like to express my sincere gratitude to my committee chair, Professor Peng Liu, who guided me through the master study at Cornell University. During my arduous probe in the real estate industry, he helped me lay a sound foundation in finance and market intuitions, as well as extend my interest in the commercial mortgage-backed securities (CMBS). Without his enlightening instructions, extraordinary kindness and patience, I could not have completed my thesis. His achievement and accomplishment in the real estate industry also inspired me to explore further in the discipline. I shall also extend my thanks to my committee members, Professor Eva Steiner, and Professor Linda Canina, who provided precious suggestions to my master thesis and fascinated me by their mature research skills and integrity.

I should also acknowledge the sacrifice my parents made to support my study and life in the U.S. Their selfless devotion to my future development rendered my master study possible. Equally important are my most fabulous friends I encountered at Cornell, especially Yiwei, Issy, and Rachel, who mentally bolstered me along with the battle towards the master's degree. The mellifluous memories I had with them will be the life-long treasure hoarded in my heart and will console myself whenever I am in trouble in the future. As always, I must thank my significant other for the companion and continuous support along the way.

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Abstract

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Key Words: Hotel Portfolio, Hedonic Model, Premium and Discount, Diversification

Introduction

Commercial real estate is a fundamental asset class in the portfolios held by different investment institutions. Hotel real estate property, as an important part of the commercial real estate industry, is getting more and more popular among real estate investors given its different income generating pattern different from other property types although it only occupies 10% of the transaction volume in the CRE world according to Florance et al. (2010). The hotel properties can adjust the rental income daily and thus be an effective hedge against market inflation (Corgel, Liu & White, 2015).

An interesting phenomenon in the commercial real estate industry is the portfolio transaction, which bundles up different pieces of real estate and sells for a bundle and aggregated price. The portfolio price is not necessarily the summation of the prices of the different pieces. Instead, it can be premium or discount to the fair value of the prices of the individual pieces. As for the role of hotels in the portfolio transactions, according to the CoStar database, 17% of the commercial real estate transactions involve hotel properties as of 10/31/2018, which is larger than the share in terms of the total transactions. Illustrated by Campell, Petrova & Sirmans (2003), various papers have covered the topic of real estate portfolio transactions to measure the premium and discount scenario to the buyers. However, these papers only used a small sample size, which is less than 100 properties, to delineate the market. As revealed by Ghent, Torous & Valkanov (2018), the pricing dynamics of the commercial real estate is esoteric to track and understand given the lack of the comprehensive data caused by the private and irregular nature of the real estate transactions. One of the tasks of this paper is to use the hotel transaction data from the CoStar database, which contains the most comprehensive real estate transaction data collected by

the analysts, to depict a general picture of the U.S. hotel portfolio transactions by predicting the prices of the individual hotels within the portfolios.

The motivation behind those hotel portfolio transactions is also of great interest among both the research papers and the industry practitioners. Many real estate financial news covered the topic on hotel portfolio transactions and tried to excavate the motivations of them. Diversification purpose is the emphasis of the media coverages. For example, Starwood Capital sold a $2 million hotel portfolio to a Chinese life insurance company by saying that:

“We are honored to have been given the opportunity to serve as stewards of China Life’s capital and thrilled to embark on a partnership that represents a first-of-its-kind relationship for our firm. They are looking for diversification, and it might extend the real estate cycle.”

Additionally, AccorHotels intended to sell its 85-hotel portfolio in Europe to HotelInvest, quoting that:

“This wide-reaching, innovative transaction is another key step in the transformation of HotelInvest. We are delighted to be contributing to the emergence of a major new hotel investor in the European market, which we intend to support over the long term.”

Similarly, the extant literature related to the motivation of real estate portfolio transactions also accentuates on the diversification effect, both geographically and typologically. Little of these papers investigates the company-level and portfolio-level characteristics of the portfolio

transactions. This paper intends to address the following questions: 1) what are the hotel-specific characteristics helpful for predicting the hotel transaction prices, 2) what is the general picture of the premium and discount scenarios of the U.S. hotel portfolio transactions, and 3) are there any company-level or portfolio-level characteristics other than diversification effect affecting the premium and discount scenario of the hotel portfolios in the U.S. The answers to these questions will help us comprehensively understand the story behind the U.S. hotel portfolio transactions.

The remainder of this study is organized as follows: Section 2 conducts a thorough literature review related to the topic of real estate valuation model and real estate portfolio transaction theories. Section 3 introduces the methodology to perform the empirical study. Section 4 elaborates the data used in this study. Section 5 discusses the result of the valuation model, the premium/discount scenario identification, and the factors affecting the scenario. Section 6 concludes the study as well as provides the future research direction and the limitations of the study.

Literature Review

In this section, I will thoroughly review the existing literature related to this study. First, general real estate valuation models are examined in detail to provide insights on the model identification in this study, given the nature of the dataset. Second, various determinants of hospitality-specific property valuation are to be checked and specified in order to determine the relevant variables put in the valuation model. Finally, a summary of real estate portfolio theories is conducted to shed lights on the possible factors influencing portfolio discount and premium scenarios. Research gap and contribution of this paper can thus be concluded based on the existing literature.

Real Estate Valuation Model

The real estate valuation methodology is of vital importance in this research since it is the starting point of premium and discount scenario identification and the determinant of the analysis accuracy. Hedonic model is appropriate in terms of the massive data set for this research.

Hedonic pricing model proposed by Rosen (1974) is the most prevalent real estate valuation model used in the literature. This model treated goods as a bundle of characteristics, and the price differences among different goods in the same kind can be attributed to the observed characteristics. Given that real estate is also a kind of good in the economic sense, the hedonic model can be well deployed to value the real estate properties using their unique observed traits. However, most of the literatures using hedonic pricing model focused on the impact of some specific characteristics on the value of the real estate properties (Corgel, Liu, & White, 2015;

Wiley & Wyman, 2012; Aroul & Hansz, 2014; Das, Smith, & Gallimore, 2018; Fuerst & McAllister, 2011; Billings, 2015; Corgel, 2007; Roubi & Litteljohn, 2004; Santos, 2016). For example, Fuerst & McAllister (2011) investigated how the environmental certification impacted commercial real estate assets, whereas Corgel (2007) dug deep into the technological impact on prices of hotel properties. Different from the explanatory perspective, Chu & Liu (2016) employed the hedonic model and sales comparison technics to forecast property values to come up with free cash flow of the companies. Ghysels et al. (2013) also elaborated the detailed procedure on how to use the hedonic model to construct real estate indices. Generally, the hedonic model is suitable for extensive data set since the degree of freedom will not be hamstrung by the many variables in the model. The reason why most of the research used a hedonic model to explain rather than forecast is that it is subject to specification bias and multicollinearity problem that are hard to avoid. Besides, the hedonic model may induce spurious effects caused by the irrelevant but significant variables (Shiller, 2008).

An alternative yet the predominant approach is the sales comparison approach, which entails both the identifications of comparable sales with similar attributes and the price adjustment given the differences among the characteristics. According to Lipscomb & Gary (1990), four adjustment methods, matched pair mean adjusted difference, matched pair regression, matched pair differences regression and regression on all sales, are used to calculate the adjustment factors, including which matched pair regression yielded the best results among the four. Apart from these four methods, Lai et al. (2008) and Lisi & Iacobini (2018) initiated some new technics to address the limitation of the traditional methods. However, most of the sales comparison approach used in the literature pertains to the residential real estate market, where the characteristics of properties are more homogenous than those in other markets, such as the

hotel real estate market in this study. Additionally, the sales comparison method is also criticized by its arbitrary and subjective nature in selecting the matching pairs (Worzala, Lenk & Silva, 1995).

First introduced by Bailey et al. (1963), the repeat sales approach has been adopted in many extant kinds of literature to construct real estate price indices and valuation models. This method only takes the properties with multiple sales into account to try to mimic the market trend in general without incorporating all the property-level data. Chegut, Eichholtz & Rodrigues (2013) used the repeat sales methodology to create the first London commercial real estate price index. Ghysels et al. (2013) concluded in their book that the repeat sales index is one of the most popular indices used both in academia and industry. However, this approach inevitably omits too much data given real estate market has a low-level transaction frequency (Nagaraja, Brown & Wachter, 2010), causing a severe problem of selection bias because the repeat sales cannot represent the real estate market as a whole.

Provided with the strengths and limitations of different valuation models, some scholars have tried to find ways to mingle different methods to minimize the deficiencies of the real estate price forecast. Chu & Liu (2016) took the average of the forecasted prices using a hedonic model and a sales comparison model to create a more reliable price projection by reducing the specification bias. Jiang, Phillips & Yu (2015) mingled hedonic model with repeat sales model to mitigate both the specification bias and the selection bias by including all the transaction data as well as property characteristics data. The model appeared to be more potent than the traditional hedonic indices and repeat sales indices when exercised using the Singapore real estate

transaction data. Inspired by Jiang, Phillips & Yu (2015), Galbraith & Hodgson (2018) followed the same methodology to predict the price of fine arts, which brought superior results compared to the previous forecast in terms of out-of-sample predictive accuracy. Nevertheless, the combined method still requires a fair amount of repeated sales to help identify the potential real estate cycles.

Some other real estate valuation methods are also informative. Ghysels, Plazzi & Valkanov (2007) considered a discounted rents model, which is similar to the income approach widely used in the industry, to price commercial real estate by taking the financial information into account. However, property-level financial information is hard to obtain, given that most of the real estate transactions are private ones. Methods related to artificial intelligence, such as neural network technics, have contradicting results regarding the predictive performance (Worzala, Lend & Silva, 1995). Those methods can neither capture the economic elasticity of different variables since no coefficients can be extracted from the black box.

Determinants of hospitality real estate price

In order to contrive a comprehensive hotel real estate valuation model, I need to understand the factors affecting hotel transaction prices. Given the existing factors covered in the previous literature, I can also incorporate other variables available in the data set to capture the variances of different characteristics.

As a sub-category of the commercial real estate, hotel properties share the same price-determinants with the general real estate market. The determinants can be categorized into two

dimensions: property-level characteristics and general economics of the property located. Corgel, Liu & White (2015) included many hotel property characteristics, such as effective age, number of rooms, a landmark property dummy, location, quality and a renovation dummy, and transaction characteristics, namely, buyer type and portfolio transactions. Notably, some city-level economic information is also manipulated in its hedonic valuation model. The study concluded that property specific attributes that fundamentally relate to cash flow generation are the most influential factors affecting hotel pricing and city and national market measures add only a little explanatory power to the hedonic model.

Corgel (2007) built a hedonic model using number of rooms, age, quality, sales time, location and per capita income in the region as the variables to investigate the technological impact on the hotel price, in which age has a non-linear relationship with the sales price. All the variables have significant coefficients, indicating that they are all critical factors affecting hotel prices. Roubi & Litteljohn (2004) used many detailed property-level characteristics, including number of restaurants, properties with swimming pool, tennis court, meeting and banquet facilities, and health & fitness facilities, and proximity to the airport and city center and brand, to model the UK hospitality valuation. Results turned out to be that only brand affiliation, amenities such as swimming pool and meeting rooms, number of rooms, location and year of sale are the determinants of UK hotel pricing. Santos (2016) also incorporated subjective characteristics reviewed by customers, e.g., cleanliness, location, and facilities, to the valuation model and found them all significantly valuable. O'Neill (2004) proposed a famous automated valuation model asserting that twelve-month lagging averages of net operating income, average daily rate, occupancy and number of rooms are the four significant factors vital to hotel valuation, among

which first three factors are all detailed financial and operating information not available in the data set in our study.

Given the data availability of the CoStar database and that the investors are more concerned about the property-specific characteristics embodied with the general economic information (Dermisi & McDonald, 2010), I will contain only property-level characteristics in the valuation model to predict the price of hospitality real estate price in the U.S.

Real Estate Portfolio Transactions

As summarized in the paper from Campell, Petrova & Sirmans (2003), in general, real estate portfolio transaction is a zero-sum game for buyers bolstered by much relevant research. However, these researches mainly focus on the public stock market, such as REITs, where transaction prices are transparent, and the sample size is small. For example, Booth, Glascock & Sarkar (1996) studied 94 real estate portfolio transactions using stock information to calibrate the benefit for buyers as insignificantly different from zero. Likely, McIntosh, Ott & Liang (1995) investigated 54 transactions initiated by REITs concluding that the real estate portfolio transactions are value-neutral events.

Most of the literature investigating real estate portfolio sales focus on the diversification effect, including the property type diversification and geographical diversification, in reducing the overall risk of the portfolios. Glascock & Kelly (2007) stated that property type effects are smaller than the country effects in terms of risk reduction, which contradicts with the research done by Fisher & Liang (2000), averring that sector diversification is more critical than regional

diversification. Cheng & Roulac (2007) confirmed the benefits of geographical diversification varying by property type and that the nonsystematic risk will only be eliminated when the portfolio is exposed to a large number of markets. Some scholars not only concentrated on the benefit itself but also the magnitude of the benefit given different situations. For instance, Al-Abduljader (2018) looked into the effects of international diversification and verified that the effects depend on the correlations between the markets, which is in line with the study conducted by Gallo & Zhang (2010) manifesting that the real estate portfolios with markets independent of correlations are more like to perform better, albeit of insufficient diversification. To conclude, diversification indeed generates benefits to the real estate portfolio, as shown in the Finnish real estate market (Falkenbach, 2009).

However, limited literature has covered the motivations of real estate portfolio sales other than the diversification considerations. Plazzi, Torous & Valkanov (2011) initiated research finding that, apart from the diversification effects, property-specific attributes, such as cap rates, values, and vacancy rates, will stoke the benefits even the portfolios are already well-diversified geographically. The distressed situation will also influence the valuation of the properties: in the residential market, 20% discount will be imposed on foreclosure sale (Aroul & Hansz, 2014), while in the hotel market, the discount effect will be moderated by hotel size, securitization, foreclosure, and disposal method (Singh, 2017). As a distressed portfolio, it has the charisma to attract buyers who continually seek bargains.

Research Gaps and Contributions

This paper is the first to quantify the premium and discount scenarios in both the public and private sector of the hotel real estate portfolio transactions by comparing the summation of the expected property prices and portfolio sale prices. The premium and discount scenarios will provide a more comprehensive landscape of the U.S. hotel real estate portfolio transactions without delimiting the scope within the public sector. Also, this paper fills the gaps in the portfolio transaction study by incorporating more company-level and portfolio-level characteristics to try to identify the determinants of the different scenarios.

Although there is numerous literature investigating the real estate valuation model, none consensus is reached regarding which model is the best. This paper uses the hedonic model, which is the mainstream in the existing research, to value the properties in the portfolios by highlighting the variables related to property characteristics and adding new variables not mentioned in the literature. This paper further summarizes the premium and discount scenario in the U.S. hospitality real estate portfolio by the transaction characteristics. Conclusively, this paper takes the initiative in depicting the hotel portfolio transaction in the scope of the whole nation.

Methodology

Hedonic model, initiated by Rosen (1974), is the most prevalent real estate pricing model used in both the academic research and the industry practice. Real estate, as a kind of goods in the economic sense, can be implicitly priced by the utility-bearing characteristics observed explicitly. Therefore, as a general pricing model, the hedonic model is appropriate to value the hotel real estate properties given its bundle of attributes and characteristics. However, due to the plethora of variables available, a hedonic model can over-specify variables to price the properties. Besides, multiple transactions for the same property should also be addressed in the hedonic regression model, although the portion of the data is small given the infrequency of the hotel transactions. In this research, I used the hedonic model with an adequate amount of variables by adding a repeat sales time variable to account for the multiple sales problem.

The independent variables used in this hotel real estate valuation model are hotel size, land area, hotel state, age when sold, number of floors, number of rooms, whether the hotel locates in the city, sale year, hotel star rating and the repeat sale time. I took the natural logarithm form of the sale price as the independent variable to fulfill the linear relationship of the linear regression model, which is in line with the research from Corgel (2007) and Corgel, Liu, & White (2015). I also added the square of the age when sold for testing whether there is a quadric relationship between the sale price and age, as shown in the paper by Corgel (2007). Notably, I introduced two new variables, which did not appear in the previous literature, in the hedonic model, that is city indicator and repeat sale time; the city indicator is used to measure the impact of locality and the repeat sale time is incorporated to calibrate the influence of transaction frequency. The individual data used to model the hedonic hotel prices is to be split by 80/20 to both trains and

tests the valuation model. The mean squared error of the testing dataset will be calculated to appraise the performance of the pricing model.

The mathematical expression of the hedonic model of hotel properties is as follows:

$$lnPrice_i = \beta_0 + \beta_1 lnSize_i + \beta_2 lnArea_i + \beta_3 State_i + \beta_4 Age_i + \beta_5 Age_i^2 + \beta_6 Floors_i + \beta_7 Rooms_i + \beta_8 City_i + \beta_9 Year_i + \beta_{10} Star_i + \beta_{11} Times_i + \varepsilon_i$$

where *i* is the *i*th hotel in the individual transactions, βs are the coefficients of the characteristics variables of the subject hotel properties, and ε is the error term including all the variations not explained by the model above. Among all the variables in the model above, state, city, and sale year are categorical variables, and the others are numeric ones. The state variable contains 50 states in the U.S. with California as the reference group, while the sale year variable comprises 28 years from 1991 to 2018 with the year 1991 as the reference group. City is a dummy variable in which "1" indicates the hotel property locates in the city area whereas "0" indicates it is not. The hedonic model deducted from the individual transaction data will then be employed to predict the hotel properties within the portfolio transactions. After the specification of the hedonic model, the premium and discount scenario will be further analyzed using the portfolio-level data including the company-level information gathered from Mergent-Intellect. Logistic regression will be employed to investigate the potential determinants of the premium and discount scenarios. The dependent variable of the analysis is the premium or discount scenario indicator, where "1" indicates premium scenario and "0" indicates discount scenario.

$$Scenario_i \begin{cases} 1 \; if \; the \; ith \; portfolio \; was \; sold \; at \; premium \\ 0 \; if \; the \; ith \; portfolio \; was \; sold \; at \; discount \end{cases}$$

There are 361 independent hotel portfolio transactions and I suppose that the *i*th observation can be treated as a realization of a random variable $Scenario_i$, which has a binomial distribution

$$Scenario_i \sim B(n_i, \pi_i)$$

with binomial denominator n_i and probability π_i. Suppose further that the logit of the underlying probability π_i is a linear function of the predictors

$$logit(\pi_i) = \beta_0 + \beta_1 Diversification_i + \beta_2 Portfolio\ Size_i + \beta_3 Public\ Buyer_i + \beta_4 Buyer\ Industry_i + \varepsilon_i$$

where *i* is the *i*th hotel portfolio transactions in the sample, βs are the coefficients of the potential determinants of the premium/discount scenarios, and ε is the error term including all the variations not explained by the model above. Among the four independent variables, only portfolio size is a continuous variable.

The summary of the variables of interest for this study is tabulated in Table 1 below. Since this study involves two-stage analysis, I separated the variables of interest by individual-level analysis and portfolio-level analysis.

Table 1 List of variables of interest for this study

Variable Names	Descriptions	Measurement
Individual-level analysis		
Price	Hotel sale price	Measured in dollars
Size	Size of the hotel	Measured in square footage
Area	Size of the land the hotel sits on	Measured in square footage
State	The state the hotel locates	50 states in the U.S.
Age	The age when the hotel was sold	Measured in years
Floors	Number of floors of the hotel	Measured in absolute number
Rooms	Number of rooms of the hotel	Measured in absolute number
City	Whether the hotel locates in city or not	1 for Yes and 0 for No
Year	Year when the hotel transacted	28 years from 1991 to 2018
Star	Star rating of the hotel	From 1 star to 5 star
Times	Number of times the hotel has been sold	Measure in absolute number
Portfolio-level analysis		
Scenario	Whether the hotel portfolio was sold at premium or discount	1 for Premium and 0 for Discount
Diversification	Whether the hotel portfolio was geographically diversified or not	1 for Yes and 0 for No
Portfolio Size	How many hotels were bundled in the portfolio	Measured in absolute number
Public Buyer	Whether the buyer of the hotel portfolio is public or not	1 for Yes and 0 for No
Buyer Industry	What industry does the buyer belong to	13 industries

The Data

This paper employed data from CoStar, a real estate database which contains detailed transaction information. I included hotel real estate transaction data from 1991 to 2018 for both the individual transactions and portfolio transactions. The individual transactions have individual sale prices, which are used to contrive the hospitality real estate pricing model. These individual transaction data are also further divided into two random groups for training as well as testing. The portfolio transactions are the subject of this research, to which I will deploy the pricing model based on individual transactions to calculate the expected portfolio prices against the actual portfolio prices. The comparison between the two prices will assist in the identification of premium and discount scenarios.

In order to augment the credibility of the analysis, some data points were excluded in the data set to eliminate the outliers and inaccurate data. First, all the transactions without sale prices in the individual transactions were deleted since sale price is the major concern of this research. Second, only the sale prices with confirmed sale comments were kept in that these prices are the reflection of the reality and are accurate. Thirdly, non-arm-length sales were precluded from the data set to reflect the free market conditions. Last but not least, abnormal transactions with rooms less than 6 and zero building square footage were expelled from the data set. It is also noteworthy that only the portfolios with hotel properties were analyzed in this study since the valuation of other property types can be different from hotels, which is beyond the scope of this paper. The categorical variable, City, is an indication of whether the hotel property locates in the city or not, which is not directly available from the CoStar data set. Furthermore, the geography

data and rural-urban code data were combined to identify whether a specific county is a city or not. Portfolios without a sale price are also excluded from the analysis.

The criteria above render 10,448 individual transactions and 427 portfolios and 1557 hotel properties within those portfolios. Table 2 and Table 3 below summarize the numeric variables and categorical variables of the 10,671 individual transactions used to model the hotel real estate prices. The average sale price of the hotels in the sample is around $10,400,000, with a minimum of $28,500 and a maximum of $616,000,000. The mean age of the hotel when sold is around 40 years, and the average number of rooms of these hotels is 97. Most of the hotels involved are low-rise hotels with an average number of floors of 4 and a mean size of 62,342.46 SF. Most of the hotels only have one transaction history, further manifesting that the real estate industry has a low transaction frequency. Among these properties in the transactions, most of them located in California, which occupies 22.89% of the overall transactions, whereas Florida closely chases after with a 15.25% sharing. 77.50% of the hotels transacted are located in the city area as opposed to 22.50% in the suburban area, and most of them are 2- and 3-star middle-end hotels. The sale year of these transactions does not vary too much compared to other variables, where 2007 and 2008 are peak seasons followed by a drastic slump in 2009. Recently, the hotel real estate transactions are very active, as shown in the table that the number of transactions from 2015 to 2018 stays above 700.

Table 4 and Table 5 illustrate the summary statistics of the hotel properties within the portfolio transactions. Since I need to predict the sale price of these properties using the valuation model, no sale price information is exhibited here. The average size of the properties is 131,414 SF,

which is approximately 2 times as large as those in the individual transactions, and the average number of floors, 5.69, and the number of rooms, 164.81, are larger than those in the individual transactions as well. The average age when sold is 24.18, which is smaller than that in the individual transactions. Similar to individual transactions, portfolio transactions focus more on the 3-star hotels but exert more weights on the 4-star hotels. Hotel properties sold in portfolios are also located vastly in California and Florida in terms of the state and the city in terms of the locality. In general, hotel properties sold in portfolios are larger and newer properties with higher quality compared to those in the individual transactions.

Table 2 Summary statistics for numeric variables in individual transactions

Variable	Mean	Standard Deviation	Min	Max
Building/SF	62,342.46	104,587.10	792.00	1,848,034.00
Coverage	0.27	0.42	0.00	24.72
Floor Area Ratio	1.17	3.09	0.00	119.38
Land Area/SF	147,579.30	934,024.2	609.00	57,700,000.00
Number of Floors	3.71	4.34	1.00	67.00
Number of Rooms	96.74	110.60	6.00	1840.00
Repeat Sales Time	1.51	0.82	1.00	13.00
Age When Sold	38.14	30.42	0.00	264.00
Sale Price	$ 10,384,111.45	$ 29,369,387.57	$ 28,500	$ 616,000,000

Table 3 Summary statistics for categorical variables in individual transactions

Variables	Frequency	Percent	Variables	Frequency	Percent
State			**State (cont.)**		
AK	7	0.07%	VA	206	1.97%
AL	67	0.64%	VT	19	0.18%
AR	53	0.51%	WA	319	3.05%
AZ	496	4.75%	WI	126	1.21%
CA*	2,392	22.89%	WV	13	0.12%
CO	469	4.49%	WY	12	0.11%
CT	56	0.54%	**Sale Year**		
DC	72	0.69%	1991*	80	0.77%
DE	19	0.18%	1992	65	0.62%
FL	1,593	15.25%	1993	96	0.92%

GA	405	3.88%	1994	104	1.00%
HI	19	0.18%	1995	137	1.31%
IA	78	0.75%	1996	183	1.75%
ID	19	0.18%	1997	281	2.69%
IL	301	2.88%	1998	251	2.40%
IN	122	1.17%	1999	337	3.23%
KS	60	0.57%	2000	367	3.51%
KY	54	0.52%	2001	337	3.23%
LA	58	0.56%	2002	351	3.36%
MA	267	2.56%	2003	326	3.12%
MD	140	1.34%	2004	395	3.78%
ME	56	0.54%	2005	403	3.86%
MI	111	1.06%	2006	381	3.65%
MN	112	1.07%	2007	534	5.11%
MO	86	0.82%	2008	435	4.16%
MS	25	0.24%	2009	193	1.85%
MT	24	0.23%	2010	276	2.64%
NC	250	2.39%	2011	289	2.77%
ND	12	0.11%	2012	404	3.87%
NE	47	0.45%	2013	547	5.24%
NH	35	0.33%	2014	670	6.41%
NJ	163	1.56%	2015	739	7.07%
NM	25	0.24%	2016	808	7.73%
NV	183	1.75%	2017	717	6.86%
NY	365	3.49%	2018	742	7.10%
OH	281	2.69%	**City**		
OK	92	0.88%	0	2,351	22.50%
OR	122	1.17%	1	8,097	77.50%
PA	165	1.58%	**Star Rating**		
RI	23	0.22%	1 Star*	343	3.28%
SC	112	1.07%	2 Star	3,524	33.73%
SD	23	0.22%	3 Star	5,465	52.31%
TN	170	1.63%	4 Star	977	9.35%
TX	487	4.66%	5 Star	139	1.33%
UT	37	0.35%			

*indicates reference group

Table 4 Summary statistics for numeric variables in portfolio transactions

Variable	Mean	Std. Dev.	Min	Max
Building/SF	131,413.70	253,015.00	1980.00	6,190,287
Coverage	0.30	0.95	0.00	29.33
Floor Area Ratio	2.45	20.19	0.01	762.55
Land Area/SF	260,232.30	1,054,202.00	692.00	2,510,000.00
Number of Floors	5.69	5.63	1.00	73.00
Number of Rooms	164.81	184.89	6.00	2,860.00
Repeat Sale Times	1.60	0.76	1.00	5.00
Typical Floor/SF	21,141.87	39,153.26	660.00	610,911.00
Age When Sold	24.18	23.23	0.00	224.00

Table 5 Summary statistics for categorical variables in portfolio transactions

Variables	Frequency	Percent	Variables	Frequency	Percent
State			**State (cont.)**		
AK	6	0.39%	VA	54	3.47%
AL	25	1.61%	VT	2	0.13%
AR	25	1.61%	WA	30	1.93%
AZ	31	1.99%	WI	13	0.83%
CA	170	10.92%	WY	1	0.06%
CO	78	5.01%	SD	2	0.13%
CT	17	1.09%	TN	23	1.48%
DC	14	0.90%	TX	136	8.73%
DE	2	0.13%	UT	12	0.77%
FL	156	10.02%	**Sale Year**		
GA	60	3.85%	1992	0	0.00%
HI	3	0.19%	1997	0	0.00%
IA	13	0.83%	1998	0	0.00%
ID	15	0.96%	1999	0	0.00%
IL	51	3.28%	2001	0	0.00%
IN	24	1.54%	2002	0	0.00%
KS	14	0.90%	2003	0	0.00%
KY	24	1.54%	2004	2	0.13%
LA	27	1.73%	2005	19	1.22%
MA	31	1.99%	2006	44	2.83%
MD	43	2.76%	2007	177	11.37%
ME	2	0.13%	2008	98	6.29%
MI	22	1.41%	2009	16	1.03%
MN	13	0.83%	2010	76	4.88%
MO	24	1.54%	2011	102	6.55%
MS	6	0.39%	2012	151	9.70%

MT	0	0.00%	2013	153	9.83%
NC	53	3.40%	2014	216	13.87%
ND	4	0.26%	2015	203	13.04%
NE	2	0.13%	2016	156	10.02%
NH	7	0.45%	2017	144	9.25%
NJ	53	3.40%	2018*	0	0.00%
NM	14	0.90%	**City**		
NV	29	1.86%	0	365	23.44%
NY	71	4.56%	1	1,192	76.56%
OH	36	2.31%	**Star Rating**		
OK	11	0.71%	1 Star	10	0.64%
OR	16	1.03%	2 Star	202	12.97%
PA	48	3.08%	3 Star	868	55.75%
RI	3	0.19%	4 Star	424	27.23%
SC	41	2.63%	5 Star	53	3.40%

*The reason why the percentage of 2018 transaction is much lower than expected is that the data only contains transactions that happened in the first month of 2018.

t-test for the individual transactions and portfolio transactions

To test whether the differences regarding the hotels in the individual transactions and portfolio transactions are statistically significant, I conducted several t-tests to investigate the differences between the means of some important variables in both transaction scenarios. According to the results of the variance ratio test, the two scenarios have difference variance in terms of the size, land area, number of floors, number of rooms and age when sold. Therefore, the t-tests are performed under the unequal variance assumption to ensure the accuracy. The results are summarized in Table 6 below. The differences are calculated by subtracting the mean of individual transactions from the mean of the portfolio transactions. All the differences, except that of the age when sold, are significant and negative, indicating that hotels in the portfolio transactions are larger in size, land area, number of floors and number of rooms. Similarly, the significant and positive difference in age when sold confirms the hypothesis mentioned above that the hotels in the portfolio transactions are newer compared to those transacted individually.

Table 6 t-tests results for the individual transactions and portfolio transactions

Variables	Difference	Standard Error	t	P-value
Building SF	-69,071.20	6,493.25	-10.64	0.00
Land Area	-112,653	28,235.97	-3.99	0.00
Number of Floors	-1.99	0.15	-13.35	0.00
Number of Rooms	-68.07	4.81	-14.15	0.00
Age when Sold	13.96	0.66	21.15	0.00

Although the characteristics of the hotels in the individual transactions vary a lot against those in the portfolio transactions, the hedonic model derived from the individually-transacted hotels is still valid since it successfully calibrate the influence of various characteristics of the hotels, which will incorporate and measure the differences in the two set of the data. The significant differences between the hotels in the individual transactions and those in the portfolio transactions also corroborated the motivation of the study – portfolio transactions have their own specific characteristics.

Additionally, I collected the company level data of the hotel portfolio buyers from Mergent-Intellect, which is a directory of worldwide business information (using D&B's Hoover's data) that enables users to access private and public U.S and international business data, executive contact information, industry research, and the ability to access industry profiles, to identify the possible determinants of the premium and discount scenarios. Since there are many small companies and individual investors involved in these portfolio transactions, a portion of the data are missing, and I will exclude those missing information in the portfolio-level analysis. Following Corgel, Liu & White (2015), I added buyer information into the analysis by specifying the buyer's type, a dummy variable indicating that whether the company is private or public, and buyer's industry, categorized by the SIC code. The summary statistics of the portfolio-level

variables will be elaborated in the result section after the premium and discount scenarios are identified.

Results and Discussions

In this section, I will exhibit and discuss the results of the empirical study. Both the individual-level data and the portfolio-level data will be analyzed. The individual-level analysis is conducted to predict the hotel prices within the portfolio sales, whereas the portfolio-level analysis is performed to identify the premium and discount scenarios and the potential determinants of the situations. Some explanations are provided through the documentation of extreme cases.

Individual-level Results

The correlation table of the independent variables included in the hedonic model is shown in Table 7. From the table, I can observe that there are rather strong relationships between hotel size and number of rooms and between size and star rating, with correlation coefficients above 0.6. The strong relationships may cause potential multicollinearity problem, which will affect the accuracy of the hedonic model. To justify the validity of the model, I also conducted a variance inflation factor (VIF) analysis to recheck whether the multicollinearity problem exists. As shown in Table 8, the VIFs for the numeric variables are all well below 10, and all the categorical variables entail acceptable VIFs. Therefore, no salient multicollinearity problem exists in the hedonic model in this paper.

Table 9 exhibits the result of the hedonic model used to price the hotel real estate properties in the U.S. in the portfolio transactions. I did not list all the categories within the year and state variables to make the table readable. Instead, I generalized these variables as fixed effect to

confirm whether there is an overall impact on the hotel sale price. The R-squared of the model is 78%, indicating a strong fit for the hotel transaction data. As shown in the table, there is a strong positive relationship between the sale price and the size of the hotel, indicating that the larger the hotel property, the more costs are involved in the construction of the building, which in turn reflects in the sale price. However, the relationship between the sale price and the land area is negative in the model, manifesting that the larger land area does not add additional value to the hotel property. The potential reason for the situation is that the larger land may incur low efficiency in land usage. In line with Corgel (2007), the quadric relationship between the age and sale price is corroborated in the hedonic pricing model. As the age increases, the sale price first decreases provided that the amenities and basic infrastructure in the hotel deteriorate gradually, but after a turning point, the price increases instead to reflect the renovation and the historical or vintage value inherent in the hotel property. Both the number of floors and the number of rooms have a positive relationship with the hotel sale price since the more rooms and floors, the more potential income generator there will be.

Additionally, the hotels in the city area have a higher sale price compared to the hotels in the suburban area. The reason behind is that hotels in the city area tend to set up higher market price, generating more income and thus increasing the price of the hotel. The same rationale applies to the fact that the higher the hotels' rate, the higher the sale price they endowed.

As for other factors, the sale prices of the hotels increased as the year went by from 1991 until the 2008 financial crisis when the hotel prices plummeted and then bounced back from 2011. In terms of the state factor, hotel prices vary a lot upon different states, which is an indication of the

economic potency of different states in the U.S. As the reference group, California has the third highest hotel transaction prices, surpassed by Washington D.C. and Hawaii. Notably, I did not find any significant relationship between the hotel sale price and the repeated sale time, indicating that in general, the repeated sale time did not provide any prediction power to the hedonic model. This is partly due to the fact that the hotel repeated sales were infrequent and multiple sales smoothed away the price variations. Therefore, I removed this variable from the hedonic pricing model.

Using the hedonic pricing model above and the testing data slivered from the overall individual transaction data, I derived a mean squared error of 0.54 and a percent error of 3.59% of the fitted hotel transaction prices. The statistics above are acceptable in terms of the prediction accuracy so that I will utilize the hedonic model to come up with the predicted hotel prices within the portfolios.

Table 7 Correlation table for the variables included in the hedonic pricing model

Variables	lnSize	lnLand	Age	Number Of Floors	Number Of Rooms	Star	Year	City	State
lnSize	1.00								
lnLand	0.55	1.00							
Age	-0.42	-0.40	1.00						
Number Of Floors	0.56	0.05	-0.08	1.00					
Number Of Rooms	0.77	0.41	-0.22	0.67	1.00				
Star	0.63	0.35	-0.43	0.39	0.45	1.00			
Year	0.11	0.16	0.05	0.03	0.03	0.10	1.00		
City	-0.02	-0.12	0.04	0.02	0.01	-0.01	-0.14	1.00	
State	0.10	0.13	-0.04	0.06	0.03	0.08	0.21	-0.32	1.00

Table 8 Variance Inflation Factors of the variables in the hedonic model

Variable	VIF	Variable		VIF
lnSize	4.24	Star		
lnLand	2.04		2	7.27
Age	8.47		3	8.94
Age^2	7.16		4	4.16
Number Of Floors	2.46		5	1.65
Number Of Rooms	3.49	City		1.48
Year	5.76*	State		1.09*
Mean VIF				**2.97**

*In order to simplify the table, I took the average of the VIFs of the categories within categorical variables.

Table 9 Hedonic model result

Independent Variables	Coefficient	Standard Error
lnSize	0.645***	0.01
lnLand	-0.078***	0.01
Age	-0.009***	0.00
Age^2	0.000***	0.00
Number of Floors	0.037***	0.00
Number of Rooms	0.002***	0.00
City	0.137***	0.02
Star		
2	0.034	0.04
3	0.155***	0.04
4	0.570***	0.05
5	0.761***	0.08
Constant	8.367***	0.15
Year Fixed Effect		Yes
State Fixed Effect		Yes
Observations		8,547
R-squared		0.78

***$p < 0.01$. Notes: The hedonic regression model results shown above indicates that all the variables included in the pricing model are significant and are good predictor of the hotel sale price. The 78% of R^2 further confirms that the model explains most of the variation of the hotel sale price in the U.S. market.

Portfolio-level Results

Table 10 below specifies the summary statistics of the premium/discount scenarios of the hotel portfolio transactions, including the buyers' information. The scenarios are determined by comparing the sum up of the individual expected transaction prices, interpolated by the hedonic pricing model aforementioned, within the portfolios and the actual sale prices given in the database. Among all the 427 portfolio samples included in this study, about 28% of them were sold at discount whereas 72% of them were sold at a premium, indicating that most of the hotel portfolio transactions in the U.S. were performed under the premium scenario. The average premium to the hotel portfolios is $46.17 million while the average discount exerted on the discounted portfolios is $14.27 million, whose absolute value is smaller than that of the premium situation. Properties cross states and properties cross cities are two variables indicating the geographical diversification of the portfolios. The summary statistics below tabulates that the premium scenario entails a higher percentage of geographically diversified properties than discount scenarios does, intuitively showing that diversification provides a premium to the portfolios which buyers consider beneficial. This statement echoes with the fact that premium portfolio has a larger size than the discount one has, illustrating that diversification plays an important as numerous literature mentioned. After deleted the missing company information, 361 portfolios with complete buyer's company information are remained to be analyzed. The premium portfolios had a larger portion of public buyers engaged in the transactions than discount portfolios did. In terms of the buyer's industry, both the scenarios had the biggest portion of the holding and other investment offices, including investment banks, real estate investment trusts, etc. Hotels and hotel management companies are also an outstanding group of players in the hotel portfolio transactions, being the second largest portion for both scenarios.

Whether the correlations truly exist statistically will be tested by the logistic regression discussed later in the section.

Table 10 Summary statistics of the premium/discount scenario of U.S. hotel portfolio transactions

Variables	**Discount Scenario**			**Premium Scenario**		
Numerical Variables	**N**	**Mean**	**Std.**	**N**	**Mean**	**Std.**
Actual Price (in $M)	120	$40.63	$144.50	307	$80.11	$128.90
Expected Price (in $M)	120	$54.90	$154.90	307	$33.94	$54.07
Difference (in $M)	120	-$14.27	$28.93	307	$46.17	$86.93
Portfolio Size	120	2.61	1.79	307	3.58	3.96
Categorical Variables		**Count**	**Percent**		**Count**	**Percent**
Cross State	120	22	16.67%	307	115	33.24%
Cross City	120	33	25.00%	307	166	27.98%
Public Buyer	90	11	12.22%	271	67	24.72%
Buyer's Industry						
Construction	90	2	2.22%	271	2	0.74%
Depository Institutions	90	1	1.11%	271	1	0.37%
Holding And Other Investment Offices	90	22	24.44%	271	85	31.37%
Hotel or motel management	90	3	3.33%	271	10	3.69%
Hotel	90	19	21.11%	271	73	26.94%
Insurance	90	0	0.00%	271	2	0.74%
Other Services	90	17	18.89%	271	34	12.55%
Public Administration	90	5	5.56%	271	12	4.43%
Real Estate Agents and Managers	90	12	13.33%	271	30	11.07%
Real Estate Operators	90	2	2.22%	271	5	1.85%
Retail Trade	90	2	2.22%	271	1	0.37%
Security And Commodity Brokers	90	5	5.56%	271	16	5.90%
Total Cases	120	132	27.62%	307	346	72.38%

Figure 1 shows the patterns of the absolute premium and discount value of the hotel portfolios over the year from 1991 to 2018. The red line in the graph indicates that the actual transaction price equates the expected price, above which are the premium scenarios while below which are the discount scenarios. The results shown in the graph are compatible with the summary statistics but provide more information on the trend. Right before the financial crisis in 2008, there were

lots of enormous premium appearing in the hotel portfolio transactions given the real estate bubbles and the overly optimistic perspective to the U.S. real estate market. However, after the financial crisis, especially for the year of 2009 and 2010, the premium contracted significantly due to the automatic adjustment of the market, and the discount situations came to the stage more often because of the sentiments of the real estate market and the risks involved. Recently, as the real estate market bounced back, lucrative premium scenarios appeared again, similar to the pattern before the financial crisis in 2008.

The biggest premium is about $634 million compared to an $805 million sale price, happening in 2016. The deal includes an 878-room hotel in New York City and a 194-room hotel in Miami Beach, both of which are newly renovated. The reason why the premium was so profound is that there was business value embodied in the transaction which merger and acquisition of another company were involved. However, the disclosure of the deepest discount transaction, with a discount of around $200 million, is minimal, providing no valuable information to identify the reason behind. From the data on hand, I can observe that the portfolio contains 1496 rooms and should be valued at a higher price, given the potential to generate revenues.

Figure 2 exhibits the box plot of the premium and discount percent of the hotel portfolio transactions in the U.S. The percent is calculated by dividing the difference between the actual sale price and expected sale price by the actual sale price. While the absolute value of the premium and discount provides general information of the market, the percent value offers more insights to the extent of the premium and discount. The plot shows that lots of discount scenarios lie outside the box region, indicating that when stepping into the discount scenario, the portfolio

tends to be highly discounted compared to the premium scenario. When the portfolio goes into the discount category, it is more likely that the portfolio will be deeply discounted, given the various distressing situation, such as deferred maintenance, real estate owned, auction, etc., where both the seller and the buyer have limited control of the transaction price, which can plummet quickly. Counteractively, premium portfolios tend to induce small scale of premium percentage because of the arduous and cautious negotiations involved in the transactions to make sure both parties participated split the adequate amount of the interests. Premium scenarios also tend to have higher actual transaction prices, which make the denominator of the percentage very large. Moreover, although there is no clear pattern of the premium/discount scenario over different sale years, the deep discount scenario did proliferate during recent years.

The most severe discounted portfolio contains two hotels in West Columbia, with only $0.5 million transaction price. The two hotels were subject to deferred maintenance and in nearly dilapidated condition. The 1000% of the discount percentage manifests that the portfolio lost its one-tenth of the fair value in the market when transacted in 2013.

Figure 1 Premium/Discount value from 1990 to 2018

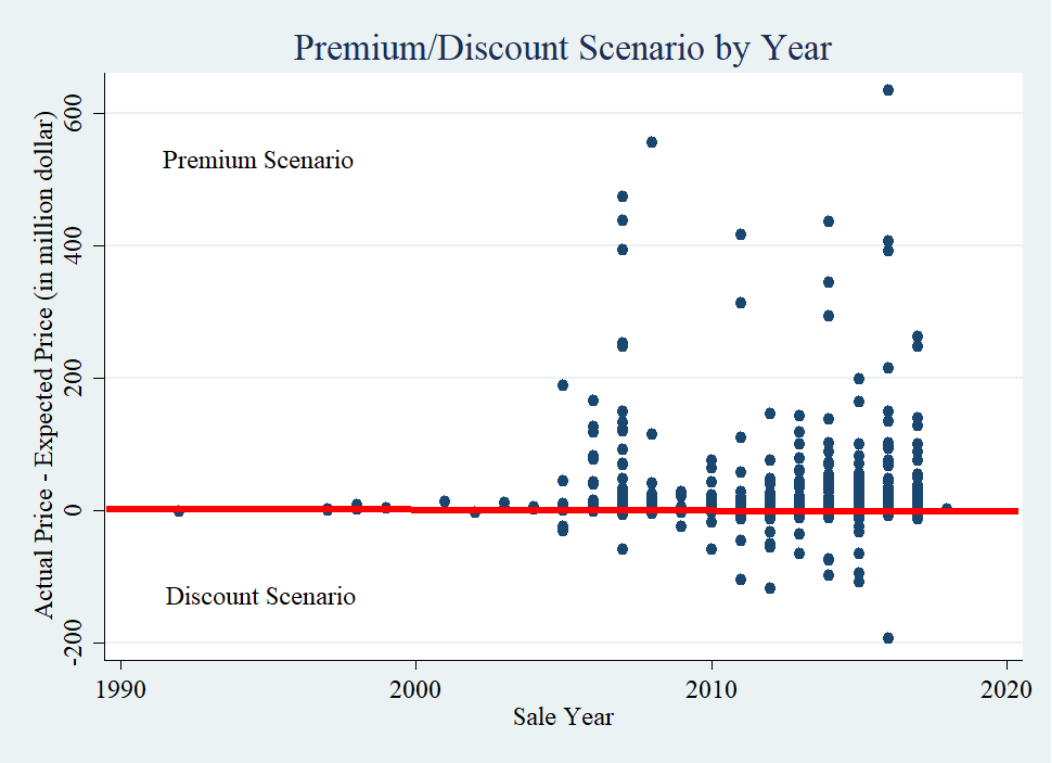

Figure 2 Box plot of the premium and discount scenario of the U.S. hotel portfolios

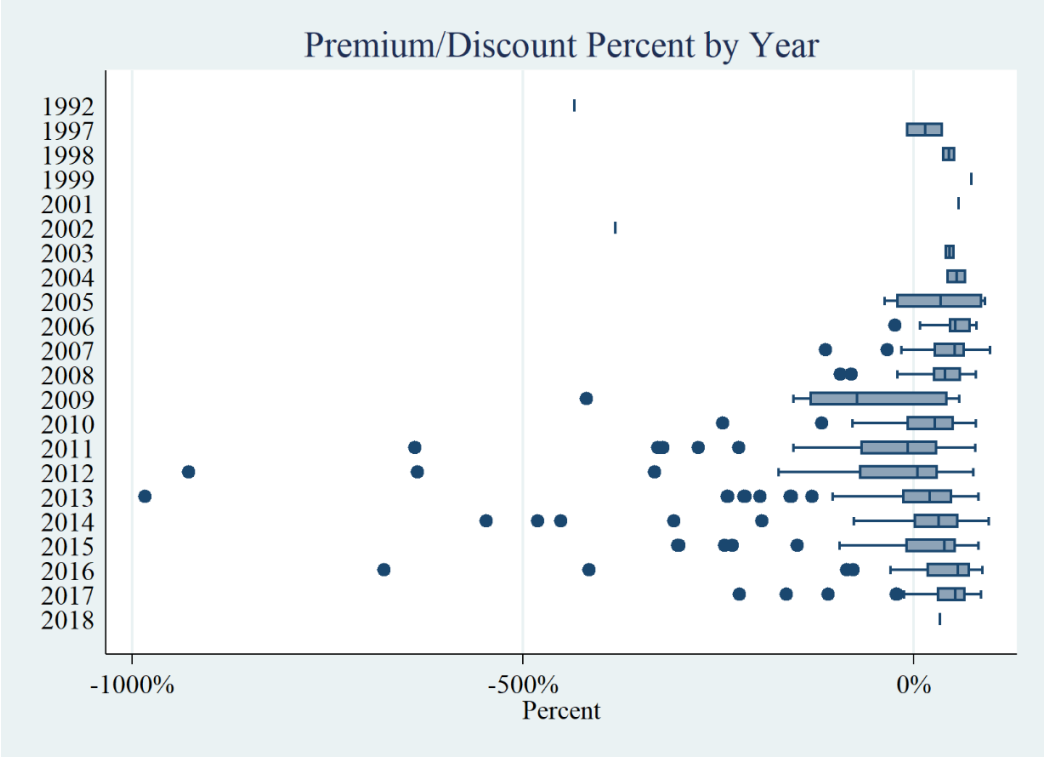

Table 11 summarizes the logistic regression of the premium/discount scenario determinants. I combined city dummy and state dummy to form a new variable, diversification, which indicates the geographic diversification the hotel portfolio had. According to the results in the table, all the variables are insignificantly associated with the premium/discount scenarios except the diversification variable. The positive odds ratio for the diversification variable further indicates that the diversified hotel portfolios are more likely to be sold at a premium than the undiversified one, which can be explained by the fact that diversified portfolios will provide hedges against the systematic risks (Cheng & Roulac, 2007). Also, hotel performance is highly dependent on the location and the different seasonality associated. Therefore, geographical diversification will provide more stability to the hotel portfolios.

As shown by Corgel, Liu & White (2015), hotels with REIT buyers tend to have a higher transaction price than those with other types of buyers. However, based on the hotel portfolio transaction data I used in this study, the inclination did not pass on to the portfolio-level transactions. I found no correlation between the public buyer/holding and other investment offices, to which REIT companies belong, and the premium scenario. Similarly, no statistical significance was found regarding the relationship between portfolio size and premium/discount scenarios. In general, apart from the diversification effect, this study finds no evident proof to indicate that company-level and portfolio-level information lend any power to explain the premium/discount scenarios. The probable reason behind the finding is that the hotel portfolios are subject to distress situations, where both the buyer and the seller in the transactions, as well as the portfolio information, have no indication of the value of the distressed properties within the portfolios. The distressed situation has been explained by the research conducted by Singh

(2017), indicating that the distress discount is moderated by hotel-specific characteristics and disposal method rather than the company-level information.

Table 11 Logistic regression result for the premium/discount determinants

Independent Variables	**Coefficients**	**Odds Ratio**	**Standard Error**
Diversification	0.54*	1.72	0.29
Portfolio Size	0.05	1.05	0.06
Public Buyer = 1	0.42	1.53	0.42
Buyer's Industry			
Construction	-0.48	0.62	1.05
Depository Institutions	-0.91	0.40	1.51
Holding And Other Investment Offices	0.25	1.29	0.41
Hotel or motel management	0.54	1.72	0.73
Hotel	0.54	1.72	0.40
Public Administration	0.22	1.24	0.62
Real Estate Agents and Managers	0.23	1.25	0.46
Real Estate Operators	0.17	1.19	0.90
Retail Trade	-1.37	0.26	1.27
Security And Commodity Brokers	0.12	1.12	0.61
Constant	0.39	1.48	0.33
Observations		361	
Pseudo R^2		0.04	

*p<0.10. Notes: The logistics regression results shown above elucidates that among the company-level and portfolio-level characteristics, only diversification effect has a positive impact on the premium scenario. The pseudo R^2 of only 0.04 indicates that factors other than the variables listed above account for more variation of the premium and discount scenarios.

Conclusions

This paper uses the hotel transaction data from 1991 to 2018 to predict the individual expected hotel transaction prices within the hotel portfolios by utilizing the hedonic pricing model. The premium and discount scenarios are then identified by comparing the actual portfolio transaction prices and the expected portfolio transaction prices.

The hedonic pricing model shows that hotel size, land area, age, number of floors, number of rooms, city location, hotel star rating, hotel state and transaction year all have a significant relationship with the hotel transaction price. The high R-squared and adequate predicting errors indicate that the hedonic model is appropriate to model the hotel price.

The results of this paper elucidate that most of the U.S. hotel portfolios were transacted at a premium, with about 72% of all the cases. The conclusion is contradicted with the finding done by Campell, Petrova & Sirmans (2003), saying that portfolio transactions, in general, are zero-sum games. Furthermore, when the portfolios are discounted, the extent of the discount is much greater than that of the premium when portfolios are traded higher than the expected price. This study also reveals that the 2008 financial crisis did witness the housing bubble when the total amount of the premium allocated to the hotels are abnormally exorbitant.

Finally, this research tries to identify the potential determinants of the premium and discount scenarios by mingling both the company-level information and the portfolio-level information. However, I found that only diversification showed some correlations with the premium scenario,

which is supported by much previous research, while other factors, including the buyer's specific information and portfolio size, cannot explain the hotel portfolio transaction scenarios.

This paper investigates the premium and discount scenarios of the U.S. hotel portfolio transactions and identifies some motivations and determinants of the two different scenarios. However, I only used the hedonic pricing model to predict the hotel real estate prices within the portfolios, rendering some inaccuracies in the predictions. Although no model will provide a perfect prediction given the complex real-world scenarios, it is still worthwhile to use different methods to identify which prediction model performs the best. Combining different pricing models will also be a plausible approach to value mass hotel properties. I attempted to combine the hedonic pricing model with the sales comparable method; however, no improvement of the prediction was achieved. Also, this paper solely focuses on the hospitality industry and can be extended to other property types to delineate a broader portrait of the U.S. portfolio transactions. By incorporating different property types, the impact of the diversified property types within the portfolios can be measured and provide more insights into the real estate market.

In general, this paper makes the first step to investigate the U.S. hotel portfolio transaction scenarios as a whole and will pave ways for the future research to help the real estate market learn more about the market dynamics and the motivations behind the premium and discount scenarios.

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